

The Impact of Cigarette Smoking and Environmental Tobacco Smoke on Nasal and Sinus Disease: A Review of the Literature

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ABSTRACT

Tobacco smoking and exposure to environmental tobacco smoke (ETS) have both been implicated in a number of acute and chronic medical problems including heart and lung disease and several cancers. The impact of tobacco smoke on disorders of the nose and paranasal sinuses is less well understood, although there is growing evidence that such exposure can have a significant impact on nasal and sinus function. A comprehensive review of the literature reveals that tobacco smoking is associated with acute and chronic rhinitis, but may actually be negatively correlated with the development of allergic rhinitis. In those patients with allergies, nasal and sinus symptoms may be exacerbated by tobacco smoking. ETS exposure is associated with acute and chronic nasal symptoms in adults and children, snoring in children and teenagers, and may be associated with an earlier onset and more significant symptoms for individuals with a predisposition to developing allergies. Both primary and environmental tobacco smoke are related to increases in nasal and sinus cancer. Tobacco smoking and ETS are associated with significant nasal and sinus disease and cancer. (American Journal of Rhinology 13, 435-438, 1999)

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Cigarette smoking has been implicated as an etiologic factor in a variety of diseases, most prominently cardiovascular disease and several cancers.¹ The rate of disease in smokers as compared with nonsmokers has been found to be three for heart disease, 10 for lung cancer, two for stroke, 25 for COPD, and two for other cancers.¹ Recently, environmental tobacco exposure (ETS) or passive, second-hand smoke has been found to be associated with upper and lower airway diseases such as asthma, and an increased risk of certain cancers.² Most articles that have addressed the health impact of ETS have revealed a strong association. Although a smaller percentage of articles do not show a relationship between ETS and adverse health conditions, a review of these articles has shown that the only factor that was found associated with a conclusion that ETS is not harmful was whether the authors were affiliated with the tobacco industry.³

The impact of cigarette smoking in the upper airway has been predominantly in its key etiologic role in head and neck squamous cell carcinomas.⁴ With the inflammatory impact to the mucosa from cigarette smoking and ETS identified, it might be expected that such exposure may result in an increased occurrence of inflammatory diseases of the nose and paranasal sinuses, or may potentiate the effects of allergens on nasal and sinus function. This article will review the current literature on smoking and ETS on the nose and sinuses and identify opportunities to evaluate further these relationships.

Smoking and Nasal-Sinus Disease

Several articles have attempted to investigate the role of cigarette smoking on disorders of the nose and sinuses. Many of these have been designed to look at the incidence

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of allergic rhinitis in smoking and nonsmoking groups. A history of smoking has been found to be associated with rhinologic findings consistent with dysplasia, such as hyperkeratosis or leukoplakia.⁴ Using the second National Health and Nutrition Examination Survey, 1976 to 1980 (NHANES II), the prevalence of upper and lower respiratory conditions was compared. Smokers reported all upper and lower respiratory conditions more often than nonsmokers except allergic rhinitis without asthma, which was reported more by nonsmokers.⁵

Cigarette smoking increased nasal airflow resistance, especially in young adults when measured in healthy adults, those with asthma, or those with rhinitis.⁶ Current smoking is a habit significantly more frequent in men reporting chronic rhinitis, and this relationship was dose dependent with greater smoking, resulting in a greater reported history of chronic rhinitis.⁷ A survey of 27,604 individuals predominantly in the 17 to 19-year-old age groups revealed a close relationship between smoking and chronic nasal symptoms.⁸ A study in Korea using a combination of a nationwide survey, family histories, and physical examinations did not find smoking to correlate as a risk factor for chronic rhinosinusitis. The criteria, however, for chronic rhinosinusitis were not very well established; and it is therefore difficult to assess the relationship between smoking and chronic rhinosinusitis.⁹

When the role of smoking is evaluated in relationship to allergic upper airway disease, not only is there no strong association, but there is good evidence that allergies are less common in smokers. Smokers have been found to have greater serum concentrations of IgE.^{10,11} Serum IgA levels have also been found to be significantly increased in smokers but reduced in allergic individuals.¹² When evaluating allergy skin testing, smokers have lower levels of reactivity than nonsmokers,¹³ self reported incidence of hay fever¹⁴, or nasal nonspecific responsiveness.^{14,15} In other studies, no relationship could be identified between smoking and allergic rhinitis.^{16,17} In those patients with rhinoconjunctivitis, however, stopping smoking has been found to favor remission of the rhinoconjunctivitis.¹⁸

When comparing a group of nonatopic and atopic subjects who were matched for smoking habits, it has been found that the threshold for airway resistance to inhaled methacholine challenge was not different among nonsmoking atopic and nonatopic subjects. However, among the smokers, those with allergic rhinitis had a threshold three doubling doses lower than those without allergic rhinitis. It was concluded that there is a combined effect of chronic cigarette smoking and allergic rhinitis that affects nonspecific airway responsiveness.¹⁹

Environmental (Second Hand) Tobacco Smoke Exposure and Nasal-Sinus Disease

Although the relationship between smoking and nasal disorders or allergic rhinitis is not firmly established, a stronger relationship seems to be present between envi-

ronmental or second-hand smoke and nasal disease or allergic rhinitis. The California Environmental Protection Agency, in their 1997 report, "Health Effects of Exposure to Environmental Tobacco Smoke," recognized that exposure to environmental tobacco smoke can result in chronic respiratory symptoms in children and eye and nasal irritation in adults.²⁰ Wittig et al. evaluated factors that were associated with the age of onset of allergic disease and sensitivity to certain specific antigens. Smoking parents was one of the risk factors that was associated with an earlier age of onset of allergic disease, including allergic rhinitis.²¹ Maternal smoking during pregnancy may be a risk factor for the development of childhood asthma by the age of 1 year.²² Childhood snoring has been found to be associated with a history of parental smoking.²³ The prevalence of habitual snoring increases significantly in a dose-effect relationship with the number of cigarettes smoked by parents.²⁴ Frequent colds and general sinus symptoms in children in Boston ages 4 to 11 were found to be significantly associated with maternal smoking.²⁵ In teenagers, nasal symptoms and night cough have also been associated with exposure to smoking at home.²⁶ These studies would suggest that there is a strong correlation between acute and chronic nasal and sinus symptoms in children with exposure to environmental smoke. In a survey of 43,732 adults who completed the Health Promotion and Disease Prevention supplement in the 1991 National Health Interview Survey sponsored by the Centers for Disease Control and Prevention, never-smoking adults exposed to ETS reported more acute health effects than those who were not exposed to ETS.²⁷

The association between environmental smoke exposure and the development of allergic disease has been investigated in a few reports. Marini et al.²⁸ developed a case-control prospective study to assess an allergy prevention program in children up to 36 months of age. Several interventions were assigned to children with high atopic risk (279 infants), but not assigned to others (80 infants). One of the interventions was the elimination of ETS. Both groups had similar atopic risk. Conjunctivitis and rhinitis were present after the second year in both the intervention and nonintervention groups. Relapse of symptoms was less in the intervention group, and there were fewer intervention group children with two or more different allergic symptoms. Of the factors evaluated in the nonintervention group, parental smoking was found to be important in the pathogenesis of allergy symptoms.²⁸ A survey of school children in Italy designed to assess the frequency of allergic disorders suggests that only two risk factors seem to be significantly associated with the development of allergies: a history of allergic rhinitis in at least one parent, and exposure to passive smoking.²⁹ A recent meta-analysis of articles, however, evaluating parental smoking and allergic disease found no consistent association between parental smoking and allergic rhinitis or eczema. Parental smoking, either before or immediately after birth, was determined to

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unlikely to increase the risk of allergic sensitization in children.³⁰

There is a group of individuals who report a variety of nasal and upper respiratory symptoms when exposed to low levels of common volatile organic mixtures including cigarette smoke.³¹ Significant differences have been found in rhinitis symptoms, nasal airway resistance, and maximum nasal inspiratory flow in environmental tobacco smoke sensitive (ETS-sensitive) individuals between exposure to clean air and sidestream tobacco smoke. Nasal airway resistance increased by as much as 265%.³² Normal, healthy subjects have also been demonstrated to develop nasal congestion, irritation, and increased rhinitis with exposure to moderate levels of environmental or sidestream smoke. In these individuals, total cell counts, neutrophils, and albumin were not measurably changed, and there was no evidence of increased vascular permeability. Those individuals with a history of environmental smoke sensitivity had the greatest physiologic and inflammatory responses.³³ ETS-associated rhinorrhea symptoms seem to be related to C-fiber stimulation.³⁴ In randomly selected children, ages 11–14, no consistent effect on mucociliary clearance could be identified after passive smoke exposure using a saccharine particle test.³⁵

Smoking/ETS and Nasal-Sinus Cancer

Several studies have shown a strong correlation between passive smoke exposure and the development of nasal-sinus cancer.^{36–38} In the General Findings of the California Environmental Protection Agency's report on "Health Effects of Exposure to Environmental Tobacco Smoke," nasal-sinus cancer was determined to be a health effect associated with exposure to environmental tobacco smoke.³⁹

In a cohort study by Hiriyama, women with ETS exposure had a relative risk of developing paranasal sinus cancer of 1.7 when their husband smoked 10–14 cigarettes a day, 2.0 with 15–19 cigarettes a day, and 2.6 when greater than 20 cigarettes a day.³⁶ Two case control studies have also shown a strong correlation between nasal-sinus cancer and ETS exposure. Fukuda and Shibata have shown that the relative risk of cancer among nonsmokers was 1.4 when there was one smoker in the home, 2.0 when there was more than one, and 5.7 when there was more than two smokers in the home.³⁷ Zheng et al. have shown that nonsmoking men who had a wife who smoked had a three-fold risk of developing nasal-sinus cancer than did men who had no exposure.³⁸

A fivefold increased risk of cancers of the nasal cavity and paranasal sinuses is found in individuals with heavy smoking history.³⁹ The risk of cancer with any use of tobacco, however, is more modest (OR about 5.1).³⁹ The smoking effect is greater for development of squamous cell carcinoma of the nose or sinuses than for other cancers such as adenocarcinoma.^{39,40} Fukuda and Shibata have shown that smoking 39 or more cigarettes a day was significantly associated with the risk of squamous cell carcinoma of the maxillary sinus with a relative risk of 4.6.³⁷

SUMMARY

Cigarette smoking seems to be associated with several chronic and acute nasal and sinus disorders, including nonspecific nasal inflammation, acute and chronic rhinitis, and nasal-sinus cancer. Smoking has also been shown to alter mucociliary transport and increase nasal resistance. Smoking does not seem to be associated with the development of allergic rhinitis, although individuals with allergic rhinitis may be susceptible to the effects of smoke.

A strong correlation has been identified between environmental tobacco exposure and acute and chronic rhinitis in adults and children, and snoring in children. The absence of ETS may delay the onset of allergies in susceptible individuals. ETS is also strongly associated with nasal-sinus cancers among nonsmokers.

Although the association is strong and well documented in the literature, controlled, prospective trials are scarce. In addition, little is known about the impact of smoking cessation or prevention on ETS in reversing the nasal or sinus symptoms. Such studies should be an important step in the efforts of the rhinologic community to limit the impact of cigarette smoke and ETS on nasal and sinus disease. Investigations directed at altering the environment of children to be ETS-free are particularly important and strongly encouraged. This might include prospective studies of nasal and sinus symptoms and findings when ETS is removed from the environment of children where prior ETS exposure was present.

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